

DTL12977281  
CAGE Code: 19200  
AMENDMENT 2  
30 September 2002  
SUPERSEDING  
AMENDMENT 1  
22 January 2002

DETAIL SPECIFICATION

CHARGE, PROPELLING, M233/M234  
PARTS AND CONTAINER ASSEMBLY

This amendment forms a part of DTL12977281, dated 30 September 1996.

PAGE 4

3.5:

Delete "assembly...12.95 and not more than 21.55" and substitute "assembly...11.75 and not more than 20.95"

Delete "closure...19.95 and not more than 28.55" and substitute "closure...18.75 and not more than 27.95"

PAGE 8

4.4.1.a, Delete "(2) Diphenylamine from..." and substitute "(2) Ethyl Centralite or Diphenylamine from..."

4.4.1.b (2), Delete in its entirety and substitute the following:

"(2) Silicone or Waterproofing Agent from one manufacturer."

PAGE 12

4.4.3.1, Delete in its entirety and substitute the following:

"4.4.3.1 Composition. The container moldings and closure material shall be selected from each lot and tested in accordance with 4.5.1. The container moldings shall be free of silicon/waterproofing agent. The lot shall be rejected if the sample fails to comply with the requirements."

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DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

4.4.3.2, Delete in its entirety and substitute the following:

"4.4.3.2 Stability heat test (134.5C). The container moldings and closure material shall be selected from each lot and tested in accordance with 4.5.2. The container moldings shall be free of silicon/waterproofing agent. The lot shall be rejected if the sample fails to comply with the requirements."

PAGE 13

4.5.1.1:

Delete "4.5.1.1" and substitute "4.5.1.1.2"

Add new paragraph "4.5.1.1 Ethyl Centralite (EC) and Diphenylamine (DPA)"

PAGE 14

4.5.1.1:

Delete "4.5.1.1.1" and substitute "4.5.1.1.2.1"

Add new paragraph "4.5.1.1.1"

Add new paragraph "4.5.1.1.1.1"

PAGE 22

4.5.5, Delete in its entirety and substitute the following:

"4.5.5 Water repellency test. The container assemblies will be tested for water repellency by brief immersion in water (1 minute) and acceptance by weight of the coated container assembly. Seal the loading hole of sample after waterproofing with closure material. Weigh the container assembly prior to immersion. Completely immerse the container assembly in water for 1 minute. Remove and dry surface water with absorbent cloth. Weigh the container assembly and calculate water absorption per the formula:

$$(\text{weight after immersion} - \text{weight before immersion}) / \text{weight before immersion} \times 100\% = \text{water absorption}$$

Percent of water absorption not to exceed 10% Water immersion is considered a destructive test and samples shall be removed from the lot when testing complete."

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AMENDMENT 2

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The margins of this amendment are marked with an asterisk or vertical line to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

DTL12977281  
CAGE Code: 19200  
AMENDMENT 1  
22 January 2002

DETAIL SPECIFICATION  
FOR THE  
CHARGE, PROPELLING, M233/M234  
PARTS AND CONTAINER ASSEMBLY

This amendment forms a part of DTL12977281, dated 30 September 1996.

PAGE 8

4.4.1.b (2), Delete in its entirety and substitute the following:

"(2) Silicone or Waterproofing Agent from one manufacturer."

PAGE 12

4.4.3.1, Delete in its entirety and substitute the following:

"4.4.3.1 Composition. The container moldings and closure material shall be selected from each lot and tested in accordance with 4.5.1. The container moldings shall be free of silicon/waterproofing agent. The lot shall be rejected if the sample fails to comply with the requirements."

4.4.3.2, Delete in its entirety and substitute the following:

"4.4.3.2 Stability heat test (134.5C). The container moldings and closure material shall be selected from each lot and tested in accordance with 4.5.2. The container moldings shall be free of silicon/waterproofing agent. The lot shall be rejected if the sample fails to comply with the requirements."

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DTL12977281  
AMENDMENT 1

PAGE 22

4.5.5, Delete in its entirety and substitute the following:

"4.5.5 Water repellency test. The container assemblies will be tested for water repellency by brief immersion in water (1 minute) and acceptance by weight of the coated container assembly. Seal the loading hole of sample after waterproofing with closure material. Weigh the container assembly prior to immersion. Completely immerse the container assembly in water for 1 minute. Remove and dry surface water with absorbent cloth. Weigh the container assembly and calculate water absorption per the formula:

$$(\text{weight after immersion} - \text{weight before immersion}) / \text{weight before immersion} \times 100\% = \text{water absorption}$$

Percent of water absorption not to exceed 10% Water immersion is considered a destructive test and samples shall be removed from the lot when testing complete."

**INCLUDES:**

**AMMENDMENT 1-PGS 25-26**

DTL12977281  
CAGE Code:19200  
30 September 1996

**DETAIL SPECIFICATION**

**FOR THE**

**CHARGE, PROPELLING, M233/M234  
PARTS AND CONTAINER ASSEMBLY**

**U.S. Army Armament Research Development & Engineering Center  
Picatinny Arsenal, NJ 07806-5000**

**Prepared by  
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**SUBMITTED BY:**

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**DATE: 13 Sept. 1996**

**Ch, Smart Munitions/Mortars Branch**

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**DATE: 16 Sep 96**

*J. Slivovsky*  
**JOHN SLIVOVSKY**

**DATE: 18 Sep 96**

**AFM, Technical Management Division**

**DISTRIBUTION STATEMENT A.**

**Approved for public release; distribution is unlimited.**

**FSC 1315**

## 1. SCOPE

1.1 Scope. This specification covers the requirements, examinations and tests for the parts and container assembly used on the propelling charge designated as Charge, Propelling, M233/M234.

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are needed to meet the requirements specified in sections 3, 4, and 5 of this specification. This section does not include documents in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all requirements documents cited in sections 3, 4, and 5 of this specification, whether or not they are listed.

### 2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (See 6.2).

## STANDARDS

### DEPARTMENT OF DEFENSE

MIL-STD-286 - Propellant, Solid: Sampling, Examination and Testing

(Unless otherwise indicated copies of the above specifications, standards and handbooks are available from the Standardization Documents Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS (See 6.4)

US ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING  
CENTER (ARDEC)

PRODUCT AND PACKAGING DRAWINGS

12977278	-	Closure.
12977281	-	Container Assembly.
12977282	-	Charge, Propelling, M233.
12977375	-	Charge, Propelling, M234.
12577583	-	Packing and Marking for Box, Fiberboard, Outer for Charge, Propelling, Container Assembly

(Copies of other Government documents, drawing, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

PUBLICATIONS

CODE OF FEDERAL REGULATIONS

49 CFR	-	Interstate Commerce Commission Rules and Regulation for the Transportation of Explosives and other Dangerous Articles.
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(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402. Orders for the above publication should cite 49 CFR (latest revision)).

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, except references to higher level program unique specifications for this program, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained. (See contract provisions for additional precedence criteria.)

3. REQUIREMENTS

3.1 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection in accordance with the technical provisions herein (see 4.3 and 6.2).

3.2 Materials. Materials shall be in accordance with the applicable drawings and specifications.



3.3 Components and assemblies. The components and assemblies shall comply with all requirements specified on Drawings 12977278 and 12977281, all associated drawings, and with all requirements specified in applicable specifications and drawings.

3.4 Stability heat test (134.5°C). The nitrocellulose in the container assemblies and closure shall not completely change the color of the methyl violet paper to salmon pink color in less than thirty-five minutes when tested in accordance with 4.5.2.

3.5 Percent by weight of resin and additives, kraft and polyester staple fiber. The percent by weight of resin and additives, kraft and polyester staple fiber for the container assembly shall not be less than 12.95 and not more than 21.55 when tested in accordance with 4.5.1. The percent by weight of resin and additives, kraft and polyester, staple fiber for the closure shall not be less than 19.95 and not more than 28.55 when tested in accordance with 4.5.1.

3.6 Residue test. The container assemblies when loaded and fired ballistically shall not leave residue which will cause cartridge hang-up in the mortar tube, shall not produce flaming debris in the mortar which will cause cartridge pre-ignition, and shall not produce flaming debris on the ground when fired at Zone 4. The test shall be performed as specified in 4.5.3.

3.7 Fin-tube simulation test. The container assemblies shall satisfactorily pass the fin-tube simulation test specified in 4.5.4.

3.8 Water repellency. The container assemblies shall satisfactorily pass the water repellency test specified in 4.5.5.

3.9 Homogeneity of material. The material used to manufacture the parts and assemblies shall be uniform in structure or composition throughout. [The presence of spots of 6.0 mm or larger diameter shall indicate non-homogeneity. The presence of thin membrane-like areas shall indicate non-homogeneity. The top and bottom halves shall not exhibit non-homogeneities including cracks, splits, cuts, tears, rips or holes when tested as specified in 4.5.6. The government shall establish visual standards for acceptance/rejection prior to production with the assistance of the contractor.

3.10 Workmanship.

3.10.1 Container parts and assemblies. The container parts and assemblies shall be free of dirt, grease, or foreign materials. The container assemblies shall be free of cracks, splits, tears, rips, holes, soft spots, seam separations in accordance with the visual standards established by the Government and the contractor.

3.10.2 Packaging. Prior to sealing the packaging shall be free from foreign material. The packing shall be assembled without undue binding.

#### 4. VERIFICATION

4.1 General provisions. The inspection (examination and tests) herein shall be performed to determine whether or not the item conforms to the requirements in section 3 of this specification.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.4).

#### 4.3 First article inspection.

4.3.1 Submission. The contractor shall submit a first article sample as designated by the Contracting Officer for evaluation in accordance with provisions of 4.3.2. The first article sample shall consist of the assemblies, components and test specimens listed per Table I.

4.3.2 Inspections to be performed. As determined by the Government, the first article assemblies, components and test specimens may be subjected to any or all of the examinations and tests specified in this detail specification (see Table I) and be inspected for compliance with any or all requirements of the applicable drawings.

4.3.3 Rejection. If any assembly, component or test specimen fails to comply with any of the applicable requirements, the first article sample shall be rejected. The Government reserves the right to terminate inspection upon any failure of an assembly, component or test specimen to comply with any of the requirements. The first article ballistic test shall be rejected if:

- a. One or more hang-ups occur.
- b. One or more pre-ignitions occur.
- c. One or more rounds produces flaming debris that reaches the ground at maximum charge.

TABLE I. First article inspection.  
**CLASSIFICATION OF CHARACTERISTICS**

Title Parts and Container Assembly for Charge, Propelling, 120mm, M233/M234		SHEET 1 OF 1		DRAWING NUMBER See below
EXAMINATION OR TEST		CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	NEXT HIGHER ASSEMBLY INSPECTION METHOD REFERENCE
<u>Container, Top</u> (Dwg. 12577280) Examination for defects Homogeneity of material		15/cavity 250	3.3 3.9	4.4.2.1 Visual/4.5.6
<u>Container, Bottom</u> (Dwg. 12577279) Examination for defects Homogeneity of material		15/cavity 250	3.3 3.9	4.4.2.2 Visual/4.5.6
<u>Closure</u> (Dwg. 12577278) Examination for defects Composition <u>2/ 4/</u> Stability heat test (134.5°C)		15/cavity 100 <u>3/</u> 100 <u>2/ 3/</u>	3.3 3.5 3.4	4.4.2.3 4.4.3.1/4.5.1 4.4.3.2/4.5.2
<u>Container Assembly</u> (Dwg. 12577281) Examination for defects Weight Composition <u>4/</u> Stability heat test (134.5°C) Residue test (Ballistic) Fin-Boom simulation test Water repellency		25 <u>1/</u> 250 <u>1/</u> 5 <u>3/</u> 5 <u>3/</u> 250 <u>1/</u> 100 <u>1/</u> 50	3.3 3.3 3.5 3.4 3.6 3.7 3.8	4.4.2.4 Gage 4.5.1 4.5.2 4.5.3 4.5.4 4.5.5
NOTES: <u>1/</u> The same 350 samples may be used. <u>2/</u> An equivalent length of closure material may be used if the closure is manufactured in strip or sheet form. <u>3/</u> The same sample may be used for composition and stability heat testing. <u>4/</u> Photomicrograph shall serve as evidence of acrylic fibrillation.				

4.3.4 Initial qualification of die-press set-ups. Initial die-press set-up qualification shall be accomplished by conventional die maker techniques to check the concentricity of male-female dies. The following procedures shall be employed:

a. Strips of eutectic solder 0.8 mm in thickness are to be placed in the cavity of each die in three places. The dies are then to be closed on the strips. Subsequently, the strips are to be removed from the dies and measured with a ball anvil and ball spindle micrometer. Inner diameter, outer diameter, and base thickness measurements are to be obtained and shall be in accordance with the applicable drawing.

b. After the die-press set-ups have been qualified with solder, fifteen of each part shall be processed through each die and measured for inner and outer diameters, and base thickness. All diameters shall be in accordance with the applicable drawing.

c. All measurements obtained during die-press qualification shall be maintained on file and shall be available for government review. The die-press set-up shall not be approved for use in production if any part, assembly or solder set-up fails to comply with above requirements.

d. All die-press set-ups shall operate against the established stop and meet an established dwell time.

#### 4.4 Conformance inspection.

4.4.1 Inspection lot formation. The term "inspection lot" is defined as a homogeneous collection of units of product from which a representative sample is drawn or which is inspected 100 percent to determine conformance with applicable requirements. Units of product selected for inspection shall represent only the inspection lot from which they are drawn and shall not be construed to represent any prior or subsequent quantities presented for inspection. Homogeneity shall be considered to exist provided the inspection lot has been produced by one manufacturer, in one unchanged process, using the same materials and methods, in accordance with the same drawings, same drawing revisions, same specifications and same specification revisions. All material submitted for inspection in accordance with this specification shall comply with the homogeneity criteria specified herein, regardless of the type of inspection procedure which is being applied to determine conformance with requirements. In addition, each inspection lot shall comply with the following:

a. Each lot of container tops and bottoms contain parts produced from:

(1) Nitrocellulose from not more than two lots of one interfix number from one manufacturer.

(2) Diphenylamine from not more than two lots from one manufacturer.

(3) Acrylic fibers from not more than two lots from one manufacturer.

(4) Kraft fibers from not more than two lots from one manufacturer.

(5) Resin from one manufacturer.

(6) Each additive from one manufacturer.

b. Each lot container assemblies shall contain parts produced from:

(1) Container tops and container bottoms from not more than one lot.

(2) Silicone from one manufacturer.

(3) Hexane from one manufacturer.

(4) Adhesive, cellulose, nitrate base, type I from one batch from one manufacturer.

(5) Acetone from one manufacturer.

#### 4.4.2 Examinations and tests.

a. Classification of characteristics. Conformance examinations and tests are specified in the following Classification of Characteristics paragraphs. The contractor's quality program or detailed inspection system shall provide assurance of compliance of all characteristics with the applicable drawing and specification requirements utilizing as a minimum the conformance criteria specified. When cited herein, attributes sampling inspection shall be conducted in accordance with Table II below, using the inspection levels stated in the Classification of Characteristics paragraphs.

For the classification of characteristics, the following definitions apply:

Critical. A critical defect is a defect that judgment and experience indicate would result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the product, or a defect that judgment and experience indicate is likely to prevent performance of the tactical function of a major end item such as a tank, land vehicle, missile, aircraft, artillery, or other major weapon system.

Special. A special defect is a defect, other than critical, that judgment and experience indicate may, depending upon the degree of variance from the design requirement:

a. Result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the product; or

b. Prevent performance of the tactical function of a major end item.

Major. A major defect is a defect, other than critical, that is likely to result in failure, or to reduce materially the usability of the unit of product for its intended purpose.

Minor. A minor defect is a defect that is not likely to reduce materially the usability of the unit of product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the unit.

TABLE II. Attributes sample inspection.

Lot Size	I	II	III	IV	V	VI
2 to 8	*	*	*	*	5	3
9 to 15	*	*	*	13	5	3
16 to 25	*	*	*	13	5	3
26 to 50	*	*	32	13	5	3
51 to 90	*	*	32	13	13	5
91 to 150	*	125	32	13	13	5
151 to 280	*	125	32	32	20	8
281 to 500	*	125	32	32	20	8
501 to 1200	*	125	80	50	20	13
1201 to 3200	1250	125	80	50	32	13
3201 to 10000	1250	125	125	50	32	13
10001 to 35000	1250	315	125	80	50	13
35001 to 150000	1250	315	125	80	50	13

Numbers under inspection levels indicate sample size; asterisks (\*) indicate one hundred percent inspection. If sample size exceeds lot size, perform one hundred percent inspection. Accept on zero and reject on one or more for all inspection levels.

b. Alternative conformance provisions. Unless otherwise specified herein or provided for in the contract, alternative conformance procedures, methods or equipment, such as statistical process control, tool control, variables sampling or other types of sampling plans, etc., may be used by the contractor when they provide, as a minimum, the level of quality assurance required by the provisions herein. Prior to applying such alternative procedures, methods or equipment, the contractor shall describe them in a written proposal submitted to the Government for evaluation (see 6.7). When required, the contractor shall demonstrate that the effectiveness of each proposed alternative is equal to or better than the specified conformance provision(s) herein. In case of dispute as to whether the contractor's proposed alternative(s) provides equivalent assurance, the provisions of this specification shall apply. All approved alternative provisions shall be specifically incorporated into the contractor's quality program or inspection system, as applicable.

### CONFORMANCE INSPECTION

### CLASSIFICATION OF CHARACTERISTICS

4.4.2.1	TITLE Container, Top	SHEET 1 OF 1		DRAWING NUMBER 12977280
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	NEXT ASSEMBLY 12977281 Inspection Method Reference
<u>Critical</u>	None defined			
<u>Special</u>				
A	Homogeneity of material	100%	3.9	Visual/4.5.6
<u>Major</u>				
101	Thickness of inside wall (average of three places <u>1/</u> )	Level III	3.3	Gage
102	Thickness of outside wall (average of three places <u>1/</u> )	Level III	3.3	Gage
103	Thickness of flat (average of three places <u>1/</u> )	Level III	3.3	Gage
<u>Minor</u>				
201	Depth of flat	Level V	3.3	Gage
202	Evidence of poor workmanship	Level V	3.10	Visual
NOTE <u>1/</u> In addition, any top with an individual reading greater than 0.1 mm outside of drawing tolerance shall be considered defective.				

CONFORMANCE INSPECTION  
**CLASSIFICATION OF CHARACTERISTICS**

4.4.2.2	Container, Bottom	SHEET 1 OF 1		DRAWING NUMBER 12977279
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	NEXT HIGHER ASSEMBLY 12977281 Inspection Method Reference
<u>Critical</u>	None defined			
<u>Special</u>				
A	Homogeneity of material	100%	3.9	Visual/4.5.6
<u>Major</u>				
101	Thickness of inside wall (average of three places <u>1</u> /)	Level III	3.3	Gage
102	Thickness of outside wall (average of three places <u>1</u> /)	Level III	3.3	Gage
103	Thickness of top (average of three places <u>1</u> /)	Level III	3.3	Gage
<u>Minor</u>				
201	Evidence of poor workmanship	Level V	3.10	Visual
NOTE  1/ In addition, any top with an individual reading greater than 0.1 mm outside of drawing tolerance shall be considered defective.				

4.4.2.3	Closure	SHEET 1 OF 1		DRAWING NUMBER 12977278
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	NEXT HIGHER ASSEMBLY Inspection Method Reference
<u>Critical</u>	None defined			
<u>Major</u>				
101	Composition	100 <u>1</u> /	3.5	4.4.3.1/4.5.1
102	Stability heat test	100 <u>1</u> /	3.4	4.4.3.2/4.5.2
<u>Minor</u>				
201	Length	Level V	3.3	Gage
202	Width	Level V	3.3	Gage
203	Thickness	Level V	3.3	Gage
204	Evidence of poor workmanship	Level V	3.10	Visual
NOTES  1/ The same sample may be used for composition and stability heat testing.				



CONFORMANCE INSPECTION  
**CLASSIFICATION OF CHARACTERISTICS**

4.4.2.4	FILE Container Assembly	SHEET 1 OF 1		DRAWING NUMBER 12977281
CLASSIFICATION	EXAMINATION OR TEST	CONFORMANCE CRITERIA	REQUIREMENT PARAGRAPH	Inspection Method Reference
Critical	None defined			
Major				
101	Weight	Level III	3.3	Gage
102	Outside diameter, max.	Level III	3.3	Gage
103	Inside diameter, min.	Level III	3.3	Gage
104	Distance across open end	Level III	3.3	Gage
105	Height	Level III	3.3	Gage
106	Composition	5 1/	3.5	4.4.3.1/4.5.1
107	Stability heat test 134.5°C	5 1/	3.4	4.4.3.2/4.5.2
108	Residue test (ballistic)	125 2/	3.6	4.5.3
109	Fin-boom simulation test	Level III	3.7	4.5.4
110	Water repellency test	5C	3.8	4.5.5
Minor				
201	Evidence of poor workmanship	Level V	3.10	Visual
NOTES 1/ The same sample may be used for composition and stability heat testing. 2/ After the first successful production lot, discontinue residue testing.				

4.4.2.5 Mold examination and process requirements.

4.4.2.5.1 Qualification for new or rework die-press setups.  
 Qualification of new or reworked die-press set-up shall be in accordance with 4.3.4.

4.4.2.5.2 Process requirements. Homogeneity inspection will be performed prior to assembly of container halves.

4.4.3 Testing.

4.4.3.1 Composition. The container moldings and closure material shall be selected from each lot and tested in accordance with 4.5.1. The container moldings shall be free of silicone. The lot shall be rejected if the sample fails to comply with the requirements.

4.4.3.2 Stability heat test (134.5 C). The container moldings and closure material shall be selected from each lot and tested in accordance with 4.5.2. The container assembly sample shall be selected just prior to the application of silicone. The lot shall be rejected if the sample fails to comply with the requirements.

4.4.4 Inspection equipment. The inspection equipment required to perform the inspections specified herein is identified in the "Inspection Method Reference" column of the Classification of Characteristics listings starting with 4.4.2.1. Contractor inspection equipment designs shall be submitted for Government approval as specified in the contract. Designs which provide variable measurements instead of attributes data are preferred in order to facilitate the use of statistical process control. See 6.3 herein.

4.5 Methods of inspection. NOTE: This specification covers sampling and testing of explosive materials/munitions which are potentially hazardous to personnel. It is emphasized that all applicable safety rules, regulations and procedures must be followed in handling and processing these materials. Inert filled ammunition is to be used, whenever feasible, during testing.

4.5.1 Composition.

4.5.1.1 Diphenylamine (DPA). Cut a sample into 6.35mm pieces or smaller. Dry to constant weight using a microwave moisture analyzer. Cool the sample to room temperature in a desiccator and weigh 1 gram specimen to the nearest 0.2 mg. Transfer the specimen into a beaker, add 50 ml of 90 percent aqueous methanol, and set the beaker in a warm ultrasonic bath for 10 minutes. Disperse the specimen in the liquid by means of a homogenizer for about 2 minutes or until the specimen is completely disintegrated. Decant the liquid portion into a filtering apparatus fitted with a suitable filter paper, and retain as much of the solid in the beaker. Add a similar amount of 90 percent aqueous methanol into the beaker and redisperse the specimen in the liquid by means of the homogenizer for about 1 minute. Let most of the solid settle, then decant the liquid into the filter. Repeat the operation two more times. Transfer the filtrate into a 250 ml volumetric flask and dilute to the mark with 90 percent aqueous methanol. Shake the flask well and pipette 5 ml of this solution into a 50 ml volumetric flask. Dilute the solution to the mark with 90 percent aqueous methanol and shake well. Measure the absorbency of this solution in the spectrophotometer at 285 nm. Calculate the DPA content of the sample according to the following equation.

$$\text{DPA}\% = \frac{(y - a) 250}{b \times w}$$

Where,      y = absorbance  
               a = intercept of calibration curve  
               b = slope of calibration curve  
               w = weight of specimen, in grams

4.5.1.1.1 Calibration procedure. Dry approximately 1 gram of diphenylamine in the microwave moisture analyzer. Weigh approximately 200 mg of dry DPA to the nearest 0.2 mg. Transfer this into a 250 ml volumetric flask. Add 90 percent aqueous methanol and dissolve completely. Dilute to mark and mix well.

Pipette 5 ml of above solution and transfer into a 100 ml volumetric flask. Dilute to mark with 90% aqueous methanol and mix well. This is the standard stock solution. Pipette volumetrically the following aliquots of standard stock solution into 100 ml volumetric flasks and dilute each with 90% aqueous methanol to the mark, then mix well.

<u>STANDARD STOCK SOLUTION</u>		<u>TOTAL VOLUME</u>	
<u>Concentration</u>			
<u>Standard</u>	<u>Aliquot (ml)</u>	<u>(ml)</u>	<u>(mg/ml)</u>
1	5	100	1W/100,000
2	10	100	2W/100,000
3	15	100	3W/100,000

Where: W = weight of dry DPA, in mg.

Zero the spectrophotometer with fresh 90% aqueous methanol at 285 nm. Rinse the cell with first standard twice, then measure the absorbence. Repeat the same procedure for standards 2 and 3. Perform a linear regression analysis on absorbence and concentration of standard solutions and obtain the slope, intercept, and correlation coefficient of calibration. If the latter value is less than 0.99, rerun the standards in the spectrophotometer.

4.5.1.2 Nitrocellulose - Schulze-Tiemann Method for Nitrocellulose (NC) Determinations. Calibrate a eudiometer tube prior to assembly of the Schulze-Tiemann apparatus by suspending the tube in an upside down position and filling this with incremental volumes of aqueous ethanol solution from a burette. Take a reading on the eudiometer tube for each volume of aqueous ethanol transferred from the burette. Subtract each volume measured with the burette from the corresponding reading on the eudiometer tube. Take the average of the differences between the burette and eudiometer readings. This average is the eudiometer volume correction X.

The value of X is positive if the burette readings are smaller than eudiometer readings and vice versa.

Assemble a 250 ml round bottom flask, gas evolution apparatus, eudiometer tube, NaOH bath, lead band, heating mantle and leveling bulb as shown in Figure 1.

Calibrate the apparatus with dry standard A.C.S. grade  $\text{KNO}_3$ . Follow the procedure of analysis below using 0.5 - 0.7 g of standard  $\text{KNO}_3$ , weighed to the nearest 0.1 mg. Calculate the factor of the apparatus according to the following equation:

$$F = \frac{616.8W (273.15 + T)}{(V-X) (B-C-P-3.48)}$$

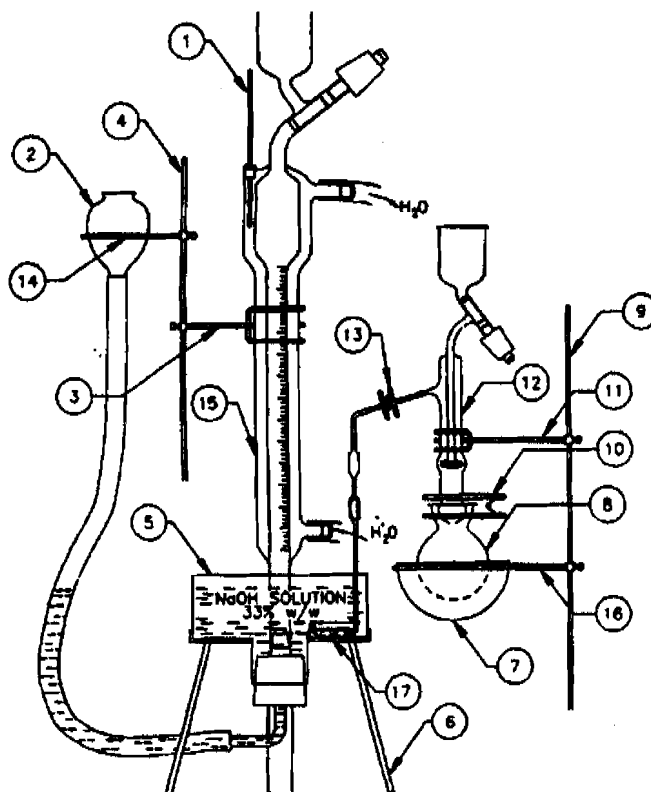
Where: F = S-T Method correction factor  
 W = mass of  $\text{KNO}_3$ , (g)  
 T = temperature of condenser water (degrees C)  
 V = volume of gas in eudiometer tube (ml)  
 B = barometric pressure (mm Hg)  
 C = temperature correction (mm Hg), See paragraph 4.5.1.2.1  
 P = vapor pressure of water over 33 percent w/w NaOH at T (mm Hg), see paragraph 4.5.1.2.2  
 X = eudiometer volume correction (ml)

Prepare samples as follows: Cut sample into 6.35 mm pieces or smaller. Dry to constant weight using the microwave moisture analyzer, then store in a desiccator.

Fill the eudiometer tube with the NaOH solution by means of the leveling bulb. Weigh between 0.7 and 1.0 g of specimen to the nearest 0.1 mg and transfer this into the round bottom flask. Add 30 ml of deionized (DI) water, heat the water to boiling and purge the flask/gas evolution apparatus assembly with steam for 5 to 10 minutes. Remove the heat for a minute, then add 25 ml of  $\text{FeCl}_2$  solution, 25 ml concentrated HCl, and 10 ml of DI water.

Place the eudiometer tube over the tip of the gas evolution apparatus and allow the reaction to continue for 20-30 minutes or until the bubbling has stopped. Add 30 ml of DI water through the addition funnel in a similar manner and continue heating for 5 to 10 minutes more. Move the eudiometer away from the gas evolution apparatus, turn off the heat, and release the vacuum in the flask by opening the addition funnel stopcock. Allow the eudiometer tube to stand for at least ten (10) minutes, then read the gas volume on the eudiometer to the nearest 0.1 ml at equilibrium pressure with the atmosphere using the leveling bulb.

LABORATORY SETUP FOR THE DETERMINATION OF NITROCELLULOSE  
BY THE SCHULZE-TIEMANN METHOD



SCHULZE-TIEMANN  
APPARATUS

LEGEND:

ITEM NO.	DESCRIPTION	ITEM NO.	DESCRIPTION
1	THERMOMETER	8	ROUND BOTTOM FLASK
2	LEVELING BULB	10,13	SOCKET CLAMPS
3,11	UTILITY CLAMPS	12	GAS EVOLUTION TUBE
4,9	RING STANDS	14,16	SUPPORT RINGS
5	SODIUM HYDROXIDE BATH	15	EUDIOMETER TUBE
6	BATH SUPPORT	17	LEAD BAND
7	HEATING MANTLE		

Figure 1. Test Setup.

Calculate the NC content of sample according to the following equation:

$$\text{Percent NC} = \frac{2.246F (V-X) (B-C-P-3.48)}{NW (273.15+T)}$$

Where: V = volume of gas in eudiometer tube (ml)  
 X = eudiometer volume correction (ml)  
 B = barometric pressure (mm Hg)  
 C = temperature correction (mm Hg), See paragraph 4.5.1.2.1  
 P = vapor pressure of water over 33 percent w/w NaOH at T (mm Hg), see paragraph 4.5.1.2.2  
 F = S-T Method correction factor  
 N = percent nitrogen in NC  
 W = mass of sample (g)  
 T = temperature of condenser water (degrees C)

Preparation of FeCl<sub>3</sub> Solution. Prepare the solution by adding 100g of FeCl<sub>3</sub>·4H<sub>2</sub>O, 1200 ml DI water, and 70 ml of concentrated HCl into a 5 liter round bottom flask. Attach a reflux condenser and reflux for 20 minutes. Cool to room temperature. Slowly add 20 grams of iron filings or powder to the cool solution. When the gas evolution stops, filter quickly. Use A.C.S. grade chemicals.

Preparation of NaOH Solution, 33 percent (w/w). Dissolve 330 g of reagent grade NaOH in 670 g of DI water.

4.5.1.2.1 Barometric pressure temperature correction (variable C). The value for variable C is obtained by using the barometric pressure (mm Hg) and the barometric thermometer (°C) with the following:

Temperature (°C) Barometric Thermometer	Barometric Pressure in mm Hg		
	740	760	780
14	1.69	1.73	1.78
15	1.81	1.98	2.03
17	2.05	2.10	2.16
18	2.17	2.23	2.29
19	2.29	2.35	2.41
20	2.41	2.47	2.54
21	2.53	2.60	2.67
22	2.65	2.72	2.79
23	2.77	2.84	2.92
24	2.89	2.97	3.05
25	3.01	3.09	3.17
26	3.13	3.21	3.30
27	3.25	3.34	3.42
28	3.37	3.46	3.55

4.5.1.2.2 Pressure correction value (variable P). The vapor pressure of sodium hydroxide solution as a function of temperature is as follows:

<u>Temperature</u> <u>(°C)</u>	<u>Vapor Pressure of</u> <u>NaOH Solution (mm Hg)</u>
18	11.6
19	12.4
20	13.2
21	14.0
22	14.9
23	15.8
24	16.8
25	17.8

The calculation of P (actual pressure) given a temperature T (actual temperature) is determined as follows:

$$P = (T - T_1) \times (P_2 - P_1) + P_1$$

Where:

- T = Actual condenser water temperature
- T<sub>1</sub> = Next lowest tabulated temperature value from T
- P<sub>2</sub> = Pressure at next highest tabulated temperature from T
- P<sub>1</sub> = Pressure at T<sub>1</sub>

#### 4.5.1.3 Acrylic.

Preparation of Samples. Each sample shall be cut into approximately 6.35 mm squares or circles. Cut and dry, in microwave or oven, approximately 2.5 g from each sample and cool in desiccator. From each sample, approximately 1.0 g test specimen shall be weighed to the nearest 0.2 mg. Test is destructive and samples shall be removed from the lot.

Analytical procedure.Solvent extraction.

Place the test specimen in a centrifuge bottle and add about 50 ml of absolute methanol. Completely homogenize the specimen in methanol for approximately 2 minutes with a polytron homogenizer. Turn the homogenizer to low speed, then with a squirt bottle of technical grade acetone, slowly add the acetone down the shaft of the homogenizer until the level reaches about 1/2 inch below the shoulder of the bottle. Stir at slow speed for 2 minutes. Centrifuge the contents in the bottle for 5 minutes and decant the liquid. Repeat the dispersion of the specimen in acetone without methanol, centrifuge the mixture, and decant the clear liquid. Rinse the polytron shaft with acetone and save the rinsing in the centrifuge bottle containing the specimen. Set up a vacuum filter equipped with an appropriate filter paper. Swirl the contents in the bottle, then pour the entire mixture into the filter funnel. Turn on the vacuum. Rinse the shaft with more acetone, catching the rinsing in the bottle, and pouring this into the filter. When all the liquid has drained into the flask, rinse the sides of the funnel with acetone to collect all the fibers on the filter paper. Leave the vacuum on for about one minute to dry the specimen. Remove the vacuum funnel, then carefully remove the filter paper and fold this over the specimen to insure no loss of material.

Reagents

SODIUM HYDROXIDE - 400 g solid NaOH dissolved in H<sub>2</sub>O and diluted to one liter.

THIOSULFATE SOLUTION - 102 g Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> · 5 H<sub>2</sub>O dissolved in H<sub>2</sub>O and diluted to one liter.

SULFURIC ACID - 93-98 percent H<sub>2</sub>SO<sub>4</sub>, N<sub>2</sub> free.

HYDROCHLORIC ACID - STANDARD SOLUTION - 0.1 N.

SODIUM HYDROXIDE - STANDARD SOLUTION - 0.1 N.

BORIC ACID SOLUTION - 40 g H<sub>3</sub>BO<sub>3</sub> dissolved in one liter aqueous solution.

POTASSIUM HYDROGEN PHTHALATE - Reagent grade.

PHENOLPHTHALEIN INDICATOR - 1 g phenolphthalein dissolved in 200 ml ethyl alcohol.

KJELDAHL DIGESTION CATALYST - Mercury-free, such as Kelmate NT.



Apparatus

Use a Buchii distillation unit or equivalent, a Buchii digester or equivalent, glass digestion tube or flask and receiving flask.

Digestion

Place the filter paper containing the specimen in a reaction tube and add one packet of Kjeldahl digestion catalyst and 25 ml of concentrated  $H_2SO_4$ . Attach the reaction tube to a manifold (by means of a clamp) which in turn is connected to a water aspirator. Set the reaction tube in the Buchii digester, turn on the latter and allow the reaction to proceed for one hour. Turn off the digester and allow the tube and content to cool to room temperature.

Distillation

Before turning on the distillation unit, open the tap water line and check the  $NaOH-Na_2S_2O_3$  solution and the  $H_2O$  reservoirs to make sure that these containers have sufficient amounts of these liquids. NOTE: The  $NaOH-Na_2S_2O_3$  solution is a mixture of 10N  $NaOH$  solution and a 102 g/l  $Na_2S_2O_3 \cdot 5H_2O$  in a 5:1 ratio. Turn the power switch on. Install an empty distillation tube and a receiving vessel into the unit. Preheat the unit for about 5 minutes. Install the distillation vessel containing the test specimen digest and a receiving vessel containing 100 ml of 40 g/l boric acid solution. Start the distillation and allow this to continue for about 5 minutes. Lower the receiving vessel and allow the collection tube to drip into the vessel. Set the latter aside for titration. Remove the distillation vessel from the unit and pour the remaining liquid into a waste storage container. Rinse the vessel with water and combine the rinsing with the rest in the waste container.

Analysis

Drain the 25-ml burette twice with standardized 0.1N  $HCl$  solution. Standardize the pH meter and electrode using a pH4 and a pH7 buffer solution. Titrate the specimen distillate collected from distillation with the standard 0.1N  $HCl$  solution to the pH of the blank solution. Note: The blank solution is prepared at least twice and measured for pH each week. Calculate the percent of acrylic fibers in the specimen as follows:

$$\text{Acrylic Fibers \%} = \frac{140 \times V \times N}{KW}$$

Where, V = volume of standard 0.1N  $HCl$  solution, in ml.  
 N = actual normality of the  $HCl$  solution  
 W = weight of test specimens, in grams.  
 K = Nitrogen content of acrylic fibers in %.

4.5.1.4 Resin and additives, kraft, and polyester staple fiber (closure). Calculate the percent resin and additives, kraft, and polyester staple fiber as follows:

$$\begin{aligned} & \% \text{ Resin} + \% \text{ additives} - \% \text{ kraft} + \% \text{ polyester staple fiber} \\ & = 100 - (\% \text{ NC} + \% \text{ Acrylic} + \% \text{ DPA}). \end{aligned}$$

4.5.2 Stability heat test (134.5° C). Samples shall be tested in accordance with MIL-STD-286, Method 404.1, heat tests at 134.5 C. Test is considered destructive and samples should be removed from lot.

4.5.3 Residue test. The test shall be performed at a Government Proving Ground. Empty containers will be loaded with M47 propellant and sealed in accordance with dwg. 12577282/12977375. Loaded containers shall then be assembled to inert-filled M934/M931 cartridges in accordance with the appropriate zones as listed in 4.5.3.1 and 4.5.3.2. Test rounds shall be conditioned for a minimum of eight hours at 21°C plus or minus 1.5°C and fired within two minutes after removal from conditioning environment. The rounds shall be fired from a 120mm M121 Carrier - Mounted Mortar at an elevation of 800 mils, at a uniform rate of 4 rounds per minute. The 120mm M120 Towed Mortar (ground mount) may be used with prior approval from the Government. The time of descent for the round from muzzle to base shall be recorded. The tube shall be dry swabbed and the elevation checked between the firing of each group.

Observation shall be made from hangups (see 6.6), external flame, and flaming debris. Presence of external flame shall be recorded by high speed video camera (304.8 meters per second minimum). The presence of external flame shall be recorded for information only. The lot shall be accepted if no hangups occur, if no pre-ignitions occur, and no flaming debris reach the ground at zone 4 only.

If a hangup occurs, the test round shall be removed from the tube and an examination shall be conducted of the tube and test round to determine if the hangup was caused by residue. If the hangup was not caused by residue, the test shall be continued. If the hangup was caused by residue, firing of test rounds shall be discontinued. The tube shall be dry swabbed and a group of reference rounds shall be immediately fired.

The reference round group shall consist of 25 rounds of the same zone, configuration, and conditioning as the test round except that loaded containers from an accepted lot shall be used. The reference group shall be fired after dry swabbing from the same tube used for the test groups. If no hangup occurs in the reference group, the test lot shall be rejected.

The test lot shall also be rejected if flaming debris reach the ground during zone 4 firing. All other flaming debris results shall be reported for information only. A formal firing report is required (see 6.8).

4.5.3.1 First article. One hundred test rounds shall be ballistically tested. These rounds shall consist of four groups. Each group shall be zone fired in the sequence indicated as follows:

<u>GROUP</u>	<u>M233/M234 ZONE</u>	<u>TEST ROUNDS</u>
1	1	25
2	2	25
3	3	25
4	4	25

4.5.3.2 Production. Fifty test round shall be ballistically tested. These rounds shall consist of two groups. Each group shall be zone fired in the sequence indicated as follows.

<u>GROUP</u>	<u>M233/M234 ZONE</u>	<u>TEST ROUNDS</u>
1	1	25
2	4	25

4.5.4 Fin-tube simulation test. The container assemblies shall be tested for flexibility needed during field use. The container assemblies may be visually examined for any homogeneity defects prior to the test. The defect-free container assemblies shall be positioned on and then removed two times from a solid bar of the maximum allowable outside diameter of the fin tube. The "snap" on and off of the tube shall be performed with the container assembly oriented perpendicular to the bar. After removal, the container assemblies shall be visually inspected for cracks, tears, open seams, crushed ends, and fold/creases in the container wall. The government shall establish visual standards for acceptance/rejection prior to production with assistance of the contractor.

4.5.5 Water repellency test. The container assemblies shall be tested for the presence of silicone by brief immersion in water (1-2 seconds) and inspection for "beading" or non-wetting. The container is held between the thumb and finger in such a way as to cover the fill hole and permit complete immersion of the container. The container shall then be withdrawn and examined. The container shall be rejected if it shows a lack of silicone or incomplete coverage as evidence by wetting or lack of beading.

NOTE: Test is considered destructive and samples shall be removed from the lot.

4.5.6 Homogeneity of material. Tops and bottoms shall be light table inspected. Any item which fails to conform with the homogeneity requirement shall be classed defective and removed from the lot.

## 5. PACKAGING

### 5.1 Packing.

5.1.1 Level A. Not applicable.

5.1.2 Level B. Exterior packing shall be as specified on 12577583.

5.1.3 Level C. Same as Level B.

### 5.2 Marking.

5.2.1 Level A. Not applicable

5.2.2 Level B. Marking shall be as specified in 49 CFR, and drawing 12577583.

5.2.3 Level C. Same as Level B.

## 6. NOTES

(This section contains information of general or explanatory nature that may be helpful, but is not mandatory).

6.1 Intended use. The components covered by this specification are intended for use on the M233/M234 Propelling Charge for 120mm mortar ammunition.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. Issues of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents reference (see 2.1).
- c. Provisions for submission of first article sample.
- d. Provisions for lot numbering and ammunition data cards.

6.3 Submissions of inspection equipment design for approval. Submit copies of designs as required to: Commander, U.S. Army Armament, Research, Development and Engineering Center, ATTN: AMSMC-AR-QAA-C, Picatinny Arsenal, NJ 07806-5000. This address will be specified on the Contract Data Requirements List, DD form 1423 in the contract.

6.4 Drawings. Drawings listed in Section 2 of this specification under the heading U.S. Army Armament, Research Development and Engineering Center (ARDEC) may also include drawings prepared by, and identified as ARRADCOM, Edgewood Arsenal, Frankford Arsenal, Rock Island Arsenal or Picatinny Arsenal drawings. Technical data originally prepared by these activities is now under the cognizance of ARDEC.

6.5 Additive. Additives shall have prior approval by the Contracting Officer. Mold release agents and processing aids are considered additives.

6.6 Hangups. For this specification, the definition of a "hangup" is a round which is dropped into the mortar tube but does not strike the firing pin with enough force to function the primer.

6.7 Submission of alternative conformance provisions. All contractor proposed alternative conformance provisions will be submitted to the Government for evaluation/approval as directed by the contracting activity.

6.8 Submission of formal proving ground firing report. Residue test data shall be sent to Commander, U.S. Army Armament, Research, Development and Engineering Center, ATTN: AMSTA-AR-QAA-C, AMSTA-AR-AEE-B, AMSTA-AR-FSA-M, Picatinny Arsenal, NJ 07806-5000.

6.9 Proving ground test summary.

TEST	SAMPLE SIZE	REQUIREMENTS
Residue test	250 containers (100 test)	Absence of hangup, (First Article) rounds, 25 reference rounds) flaming debris, zone 4
Residue test	125 containers (50 test)	Absence of hangup, (Production) rounds) flaming debris, zone 4

6.10 Subject term (key word) listing.

Ammunition, mortar  
Test, residue  
Process slurry  
Nitrocellulose